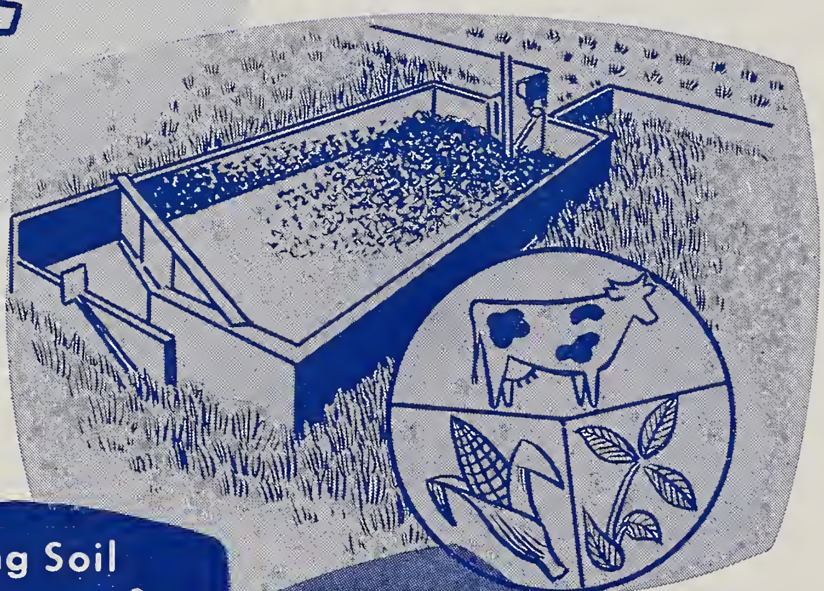
JULY 1955

AGRICULTURAL Research

Saving Swine
• see page 3



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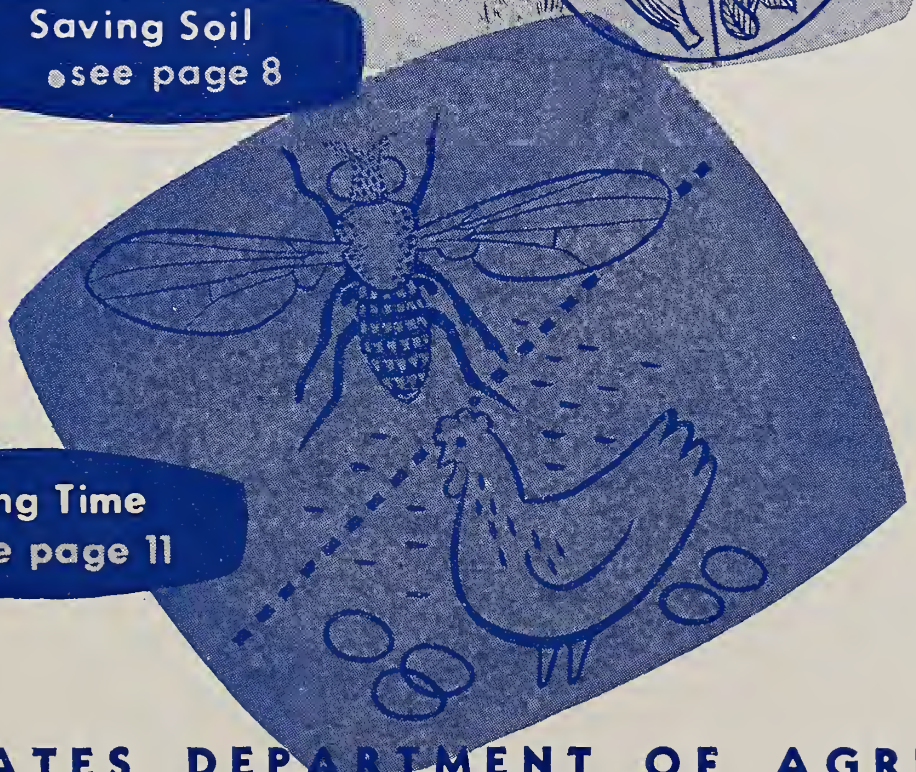

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UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL Research

Vol. 4—July 1955—No. 1
Joseph F. Silbaugh—Managing Editor
John R. Deatherage—Assistant Editor

CONTENTS

Producing livestock for less

One of today's big farm stories is being made at our dinner tables. Everyone knows that our population is growing: we will need *more* food. But *what* we eat is important, too. The fact is that *our eating habits are changing.*

As we learn more of the value of vitamins, proteins, iron, and calcium, we're shifting from high-calorie foods to more protective foods. That means more foods of *animal* origin. We're eating over a fourth more meat and poultry than we ate 20 years ago. It looks as though this trend will continue.

This means that farmers have big opportunities for expanding the production of cattle, swine, and sheep.

It also means that research can make a great contribution by helping farmers reduce costs in producing livestock.

One problem is discussed in our story on page 4: gains in the efficiency of livestock production haven't kept step with gains in the efficiency of crop production. A man-hour of labor is producing about 2¾ as much crops as it did back in 1910—but only 65 percent more livestock products.

Another point is the need to breed livestock for better quality and lower-cost production. For example, what we've learned in developing meat-type hogs may help us breed some of the back and belly fat from beef cattle—without losing the marbling that makes prime cuts. One phase of our effort to breed more productive poultry is covered in page 11.

Better feeding and management practices must be developed. Take our work on the physiology of the rumen and the nutrition and physiology of rumen microorganisms. The more we learn, the surer will be our progress in improving feed use.

Then there's the matter of controlling diseases, parasites, and insects that affect poultry and livestock. The bill runs 2.7 billion dollars a year. Progress has been made on many pests. An item on page 3 mentions another.

Along with all this, we must keep right on raising acre yields of feed crops and improving the productivity of our pastures and ranges. Feed's a big item in livestock costs.

It's apparent that we can't confine our attack on livestock production costs to just one or two of these many influences. It's the combination of all that pay's off.

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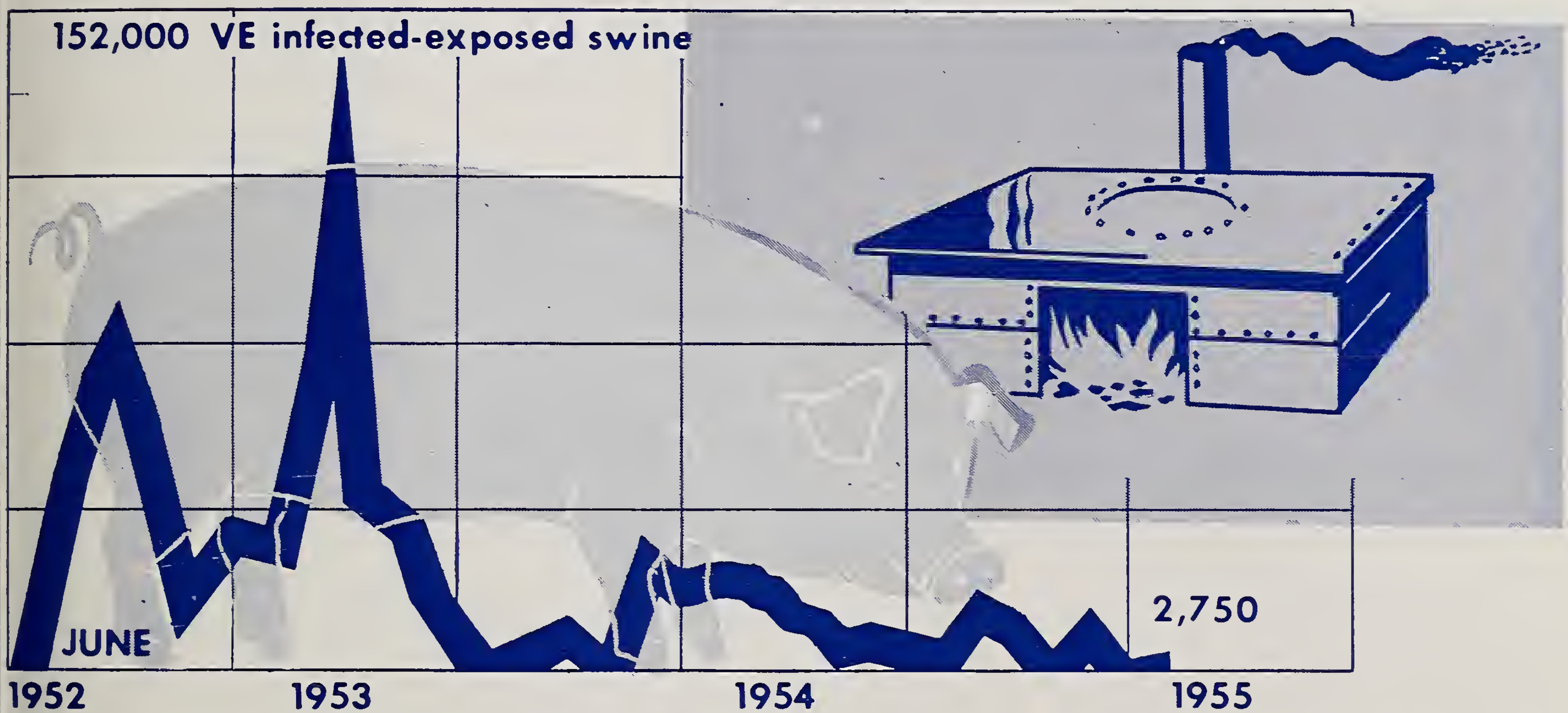
AGRICULTURAL RESEARCH SERVIC
United States Department of Agricultur

VE is DOWN

Cooperative action has now brought under control a disease that many feel should be wiped out



LESS than 3 years ago, vesicular exanthema (VE) threatened the Nation's swine industry. The disease spread by one means or another to 42 States and infected swine herds in all major producing areas. At the height of the infection, more than 150,000 hogs were afflicted or had been exposed during 1 month.

Outbreaks of VE have been reported in 264 counties in the 42 States since June 1952. Infection is now limited mostly to isolated premises in only 39 counties of 6 States.

Vesicular exanthema is a virus disease spread chiefly by feeding raw garbage (Agr. Res.. Sept. 1953, p. 10). Although this disease affects only swine, the lesions resemble those of *foot-and-mouth disease* (which affects cattle and swine) and those of *vesicular stomatitis* (which affects horses, cattle, and swine). Inoculations of test animals with material from the lesions are required to distinguish these diseases.

It was the quick action by USDA and State regulatory authorities, along with the cooperation of the livestock industry, that brought the disease under control and prevented its wider spread into non-infected areas. Steps adopted in the vesicular-exanthema control program were: (1) Quarantine of infected and exposed hogs, (2) prompt disposal of infected and exposed swine, (3) cleaning and disinfecting of infected premises, (4) cooking of garbage, (5) periodic inspection of feeding plants, (6) control of movement of garbage-fed swine, (7) inspection of garbage-fed hogs at public stockyards, and (8) cleaning and disinfecting of vehicles and facilities that are used in the interstate movement of swine.

When the livestock industry and the State Legislatures were properly informed of the seriousness of VE, action was taken to strike at its source. Laws prohibiting the feeding of raw garbage were passed by 46 State Legislatures, and the other 2 States have now introduced similar bills. Federal and State officials worked with hog feeders on their garbage-cooking problems to make the garbage safe as feed for swine.

Today, cooked garbage is fed in about 83 percent of all garbage-feeding plants, and 82 percent of the hogs fed garbage in the United States now get it cooked. Experience indicates that cooking must be 100 percent, however, for complete control. Continued efforts are being made to carry out all the previously mentioned control measures for this disease.

ARS disease-control officials feel that the country cannot afford to be satisfied with anything short of complete eradication of VE.☆

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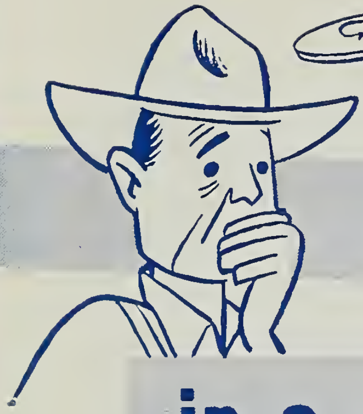
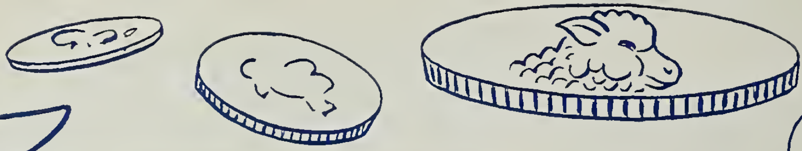




How much labor in a livestock dollar ?

WAGES ARE UP BUT OUR ANIMAL WORKLOAD HASN'T BEEN CUT MUCH

ECONOMY-MINDED farmers and researchers will take a new look at labor methods in livestock production as a result of some new figures from a USDA labor study.

The startling fact is that since the start of World War II, farm wages have quadrupled. But labor requirements for *livestock* production were being cut only 7 percent during this period, while *crop* labor inputs were being cut 34 percent. Livestock now takes 40 percent of all farm labor.

Not proved statistically but nonetheless obvious was the fact that it takes almost as much labor nowadays as it did 50 years ago to keep sideline livestock—a cow, a few chickens, and a few pigs. Progress has bypassed this phase of farming.

ARS economist R. W. Hecht, who made the study, found that among livestock the big labor user is the milk cow, as might be expected. It takes an average of 61.7 man-hours to produce $100 worth of milk. That covers only labor directly applied to livestock, such as feeding, milking, hauling feed, cleaning barns and pens, and moving and disposing of the animals and their products.

Here are some of the other man-hour requirements per $100 of product: 45 man-hours for laying and replacement chickens, only 11.9 man-hours for the more centralized and mechanized broiler production, 26.8 man-hours for sheep, 23.8 man-hours for turkeys, 15.9 man-hours for hogs, and 15.8 man-hours for beef cattle.

It's worth while to note that dairying, a big industry and a heavy user of labor in proportion to product value, also heads the list in labor required *per animal* per year. It takes 140 man-hours for a hand-milked cow, but 20 percent less—111 hours—where cows are machine-milked. Feed and litter carriers, barn cleaners, stanchion drinking cups, efficient barn arrangement, pipeline and bulk handling of milk, sale of cream instead of whole milk, and maintenance of large herds and high-producing cows all made for less work per unit of product. Regionally, the Pacific States led, followed by the Middle Atlantic States, in both milk production per cow and labor economy. The South, with smallest herds and fewest milking machines, had the highest labor requirement.

In hog production, size of herd makes the big difference in labor required. That's because a large herd can use self-feeders, self-waterers, and good pastures economically, whereas small herds can't. So the labor inputs range from 14 man-hours per $100 of pork products in the North Central States, where herds are largest, to about 25 hours in the South.

Sheep herded on the open range take quite a bit of labor, but those that are grazed on fenced pasture or range—even small farm flocks—take less than the average amount.

Large herds, a long grazing season, and a short feeding season enable the southern part of the Rocky Mountain Region to raise beef cattle with the least labor per head.

Urbanites dreaming of leisurely retirement on a small poultry farm will be interested in Hecht's findings. Labor-saving, cost-saving equipment and management practices begin to be economical with a 200-bird flock, are even more so as flock size increases. Production-line broiler raising usually takes 5 to 15 hours of labor per 100 birds, whereas the less-routinized raising of chickens to the same age for laying flocks (including culls slaughtered) takes 25 to 35 hours. Similarly, in turkey production the starting point for labor saving through equipment, work methods, and management is about 100 turkeys per flock. In the last 20 years, average flock size rose tenfold and labor input per 100 pounds declined 71 percent.

The need for whittling down the labor time in livestock production is a great challenge to agricultural research. One of the most pressing needs is for commercial-type equipment and handling methods that are adapted to medium or small farms where the herds and flocks are small—possibly sideline enterprises.☆

BEETLES sun themselves on defoliated Klamath weed.

crops and soils

GOODBYE, KLAMATH WEED

This hungry French beetle lives on a steady diet of a toxic weed that has ruined thousands of acres of range

A BEETLE that eats Klamath weed and nothing else is helping thousands of acres of weed-spoiled range to return to good grass.

In the last 5 years the beetle *Chrysolina gemellata* has made significant inroads against the toxic Klamath weed, which has choked vast stretches of range. The beetle was introduced by USDA and State entomologists in California, Oregon, Washington, Idaho, and Montana.

The situation had seemed hopeless before, but with beetles on the job its now just a matter of time.

The success story started "down under" in 1920. The Australian Government sent a team of scientists to search Europe for a parasite to control the Klamath weed. In a series of starvation and breeding tests, they found in southern France two leaf-eating beetles that met the need.

Meanwhile, these studies were followed with interest by American scientists. In 1945, entomologists of ARS and the University of California released 5,000 of these promising insects in Klamath-weed-infested Humboldt County. Today, the beetles have cleared at least a half-million California acres of this weed, and they're taking hold in other northwestern States where this weed is a serious range threat.

A survey by ARS entomologist J. K. Holloway showed that in southern-Oregon ranges, the beetles are devouring the weed, and are building up populations nearly as rapidly as they did in California. They are beginning to show promise on Washington ranches, generally; are making real headway against the weed in the good range lands of the Idaho drainage basin of the Snake and Clearwater rivers; and are providing control in some areas of Montana.

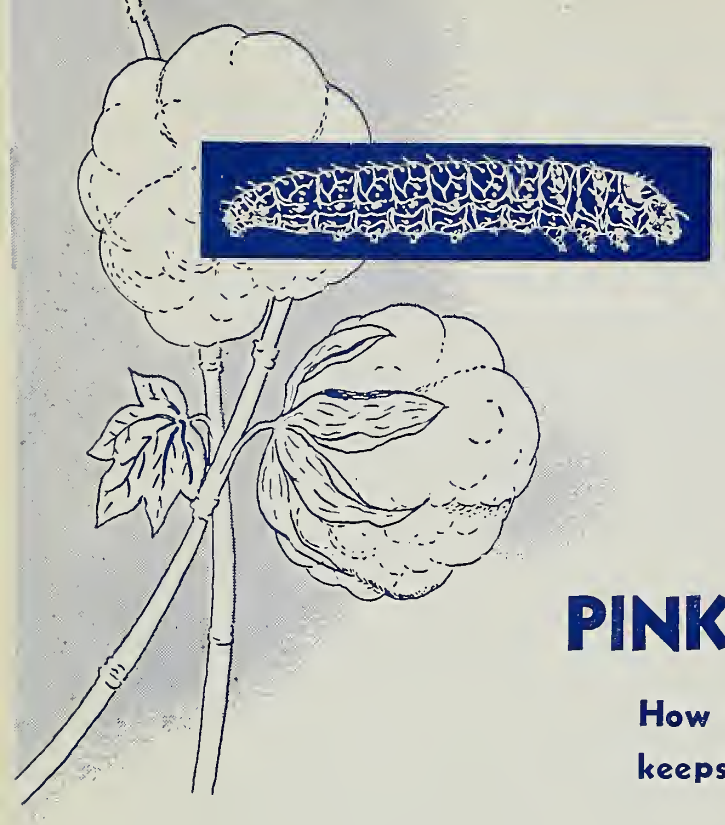
There's one bad Klamath-weed area where the parasites have failed to flourish. That is in northeastern Washington, northern Idaho, and western Montana. Soil and drought in this region keep the weeds too sparse for best beetle environment. The beetles have spread and destroyed many of the older, established Klamath weeds there, but spindly, weak, young plants often aren't touched.

Actually, there are four species of insects doing their best to wipe out Klamath weeds in the West, but *C. gemellata* far outstrips the others. It and one other species do most of their effective feeding as larvae, destroying the basal growth of the plant. Another of these insects is a root borer, and the fourth species is a fly that causes the development of galls on the stems of Klamath weeds.

C. gemellata's greater success can be explained by the neat fit of its life cycle with that of the weed. When the weed is making good growth in the winter and early spring, this beetle is avidly feeding on its foliage. When summer heat causes the weed to become dormant, the beetle goes underground for a rest. Fall rains awaken both the weed and the beetle. The insects feed and breed, and the resulting larvae consume Klamath weeds greedily during the following winter and early spring.

The other species of leaf feeder, *C. hyperici*, is not as well adapted to the climate of the Pacific Northwest but may find in the region some local areas that are more to its liking.☆

BIOLOGICAL CONTROL cleared this Placer County, Calif., field of noxious Klamath weed. A leaf-eating beetle released 5 years ago (left) killed the weed, permitted the grass to come back.



LEARNING TO LIVE WITH THE PINK BOLLWORM

How research on cultural practices keeps pace with this insect's spread

CULTURAL control practices, based on research, have been the most important factors in helping south-Texas cotton growers to produce profitable crops despite the growing menace of the pink bollworm. To keep pace with the spread of the insect, USDA entomologists A. J. Chapman and L. W. Noble are now determining how growers in other infested areas can make best use of these improved cultural practices.

Since the pink bollworm—the world's worst cotton pest—became established in the Lower Rio Grande Valley in 1936, it has steadily moved north and east across the Cotton Belt. Rigid Federal and State quarantine control programs have only been able to slow its spread. The pink bollworm now occurs in all cotton-producing areas of Texas and in parts of Arizona, New Mexico, Oklahoma, Louisiana, and Arkansas.

Here's its normal pattern of advance: Surveying entomologists out ahead of areas known to be infested find a few pink bollworms in a new location (probably offspring of adult moths carried in on air currents). In years that follow, numbers increase until the insect is economically important. By then, growers must be able to cope with it.

It was research by Chapman at Brownsville, Tex., about 15 years ago that established the validity of early-fall plowing (to bury infested bolls and stalks) as a successful control measure in the Lower Rio Grande Valley. He learned that not all pink bollworms in this sub-tropical region remain inactive in the bolls and cotton trash from harvest time until the next spring, as they do in colder climates. (Otherwise, early-spring plowing to bury the insects would have been almost as effective as fall plowing.)

Chapman found that some pink bollworms continue to emerge as adult moths in the late fall to originate other generations of the pest. Fall plowing, which buried all pink bollworms, plus destruction of volunteer cotton to eliminate host plants, made fall and winter emergence a suicide operation for these insects.

As part of a pink-bollworm research effort sponsored jointly by ARS, State experiment stations, and the cotton industry, Chapman and Noble are now conducting similar cultural-control studies at several locations. These include Brownsville, Port Lavaca, Waco, Greenville, Mount Pleasant, Vernon, and Lubbock, Tex., and Chickasha, Okla. The wide range of climate—from warm and humid at Brownsville to cold and arid at Lubbock—is representative of areas into which the insect has recently spread.

The tests compare four cultural practices: (1) fall plowing to bury infested bolls and trash; (2) spring plowing to bury infested bolls that have lain on the soil surface during the winter; (3) allowing infested bolls to remain on standing stalks over winter and then plowing them under in the spring; and (4) allowing bolls to remain on the soil surface throughout the winter.

In 2 years of experiments, Chapman and Noble have found that:

In the warm, humid areas of southern Texas, fall burial of infested bolls and trash gave the lowest pink-bollworm survival. Survival ran as low as 0.04 percent at Port Lavaca, as high as 1.35 percent at Waco.

Spring plowing-under of infested trash and bolls that overwintered on the surface was less effective than fall plowing at all locations.

Allowing stalks to stand over winter to be plowed under in the spring resulted in very low pink-bollworm survival at colder locations—Lubbock, 0.01 survival; Vernon, 0.1 percent; and Chickasha, 0.03 percent.

Allowing infested bolls and trash to remain on the surface of the ground provided least effective control. Nearly 22 percent of the pink bollworms survived at Waco and Mount Pleasant under this condition.

Entomologists consider this data significant but by no means final. They are conducting similar studies at the same locations again this year to gain further information.☆

When SUGARCANE ran out

BOTH EMERGENCY TREATMENT AND LONG-RANGE BREEDING WORK ARE INCLUDED IN OUR ATTACK ON RATOON STUNTING DISEASE

RESEARCH is moving in on ratoon stunting disease of sugarcane barely 5 years after its discovery.

Stop-gap control by heat treatment—in use in Louisiana—is providing limited quantities of disease-free seed cane. In addition, a long-range program now underway should eventually provide new varieties of sugarcane that have built-in resistance or immunity to the disease.

Australian plant pathologists discovered the disease in 1950 in "ratoon" or cane stubble. It was later found in Louisiana by ARS plant pathologist E. K. Abbott, in charge of USDA's Sugarcane Field Station, Houma, La. Both of these findings shed light on a worldwide mystery that had baffled scientists and cane growers for many years.

Sugarcane plantings had tended to "run out." That is, new canes produced well at first, tapered off in 5 or 6 years, and became commercially worthless in 10 years or less.

RATOON STUNTING DISEASE damaged sugarcane on right. Stalks are fewer, smaller, and shorter than the healthy cane on left.

Serious *known diseases*—mosaic, red rot, and root rot—cut Louisiana sugar production from an average of about 300,000 tons to 47,000 in 1926. Scientists checked further disaster by introducing disease-free seed stock from foreign countries. Later, new varieties resistant to these diseases were bred and researchers believed they had solved the mystery of declining production.

But the old story repeated itself. New varieties—still resistant to mosaic, red rot, and root rot—ran out just as old ones had. So for another 20 years, plant breeders coped with this problem only by providing a steady flow of new, vigorous, high-yielding varieties.

After ratoon stunting disease was discovered and U. S. researchers were convinced that it was the real cane-field villain, they set out to combat it. They had two facts to go on: they knew it was a virus disease and that it could be spread from infected to non-infected cane by harvesting machines and knives.

Australian researchers tried heat treatment, which had long been used by Dutch planters to obtain "better growth." The planters got that result—without knowing, perhaps, that the treatment checked disease more than it stimulated growth.

U. S. researchers got results, too. They eliminated the disease by immersing seed cane in hot water at 50° C. for 2 hours, or by holding it in heated air at 54° C. for 8 hours. The scientists found these temperatures critical. One degree *above* killed the plant buds—one degree *below* did not kill the virus. But properly treated lengths of cane, planted horizontally in furrows in the ordinary manner, sent up new, disease-free sugarcane plants from each joint.

Now, under a cooperative plan, portable heat-treating equipment is being used for emergency control by the Houma station, Louisiana experiment station, and American Sugarcane League. Treated seed cane is distributed in limited quantities much as newly released varieties are distributed. Cooperating growers at 15 "secondary increase stations" receive enough seed stock to produce 5 or 6 acres of disease-free cane, grown under close supervision. The seed thus obtained is distributed in small quantities to farmers, who produce their own stock.

Heat treatment is working as an emergency measure. But it does not eliminate chances that virus carried by farm machinery and cane knives may reinfect disease-free fields.

Researchers are therefore seeking cane varieties tolerant or immune to ratoon stunting disease. Wild and cultivated plants from many parts of the world may eventually be used in this long-term breeding program. Germ plasm required to start the work is being supplied by USDA's Sugar Plant Field Station, located at Canal Point, Fla., where the world's largest collection of sugarcane and related wild species is maintained.

The disease itself is being studied. It's insidious—growers notice it only by a slow, sure yield decline. It has little effect on sucrose, but stalks become smaller and shorter, with fewer of them millable. Worst of all, early symptoms are evident only *inside* the stalk and don't look convincing to most sugarcane growers.☆

A 7-MILLION-ACRE BELT of flat-to-gently-rolling, innately fertile soils in Central Texas is known as the Blacklands. It has been farmed for generations more or less continuously in row crops. This practice has caused erosion and water wastage on the sloping land—loss of an inch of topsoil every 10 to 20 years on a 4-percent slope—and nitrogen depletion on all of the crop land. So this land is now yielding only 21 bushels of corn and 125 pounds of lint cotton per acre on the average, and is deteriorating progressively.

Cooperative research by USDA and Texas experiment station scientists at the ARS Blacklands Experiment Station, Temple, Tex., has shown how to farm those soils better. Two accompanying stories tell how.

The soils are primarily deep, high-lime clays that can store 6 to 10 inches of available water. They continually shrink and crack, keeping pliant. Hence, they're called "dynamic" soils. Virgin grassland in the area contains 5 percent organic matter. Continuous row-cropping reduces this level to between 1.4 and 2 percent.

The scientists say even such an innately fertile, resilient soil can't stay productive unless relieved from continuous cropping to corn, cotton, and sorghum.

1 Livestock-forage team to hold soil and water

RESEARCH AT USDA's Blacklands Experiment Station, Temple, Tex., shows how to conserve the area's soil and water for a productive future without loss of income.

The indicated solution, unlike usual ones, calls for a bold change from cash cropping to livestock.

Station superintendent R. M. Smith and his associates point out that soil and water losses are negligible on sloping fields when they're covered with small-grain and sweetclover combinations. Harvesting such crops requires livestock and a shift from the system of continuous row-cropping. Blacklands farmers can afford this.

Ten years of cattle-grazing and feeding trials conducted at the Temple station proved that substituting feed crops for cash crops can more than pay its way. During this period, steer calves have averaged more than 200 pounds of gain per acre per year. With an assist from superior feed-grain varieties that have been developed in recent years, average annual gain has been as high as 600 pounds per animal. In 1953–54 trials, 50 heifer calves and 50 steer calves that were grazed and then finished in the feedlot netted nearly $10,000.

On the Blacklands, cattle feeding can be a local operation. Most farmers can provide the grazing and furnish the grain and hay for winter feeding and finishing from their own acreage. Protein supplement in the form of cottonseed meal is readily available.

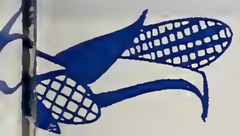
On a typical Blacklands farm, there are many possibilities for growing needed feed. Barley and oats make fall and winter cool-season pasture. Sweetclover and Sudangrass provide summer grazing. Well-managed native-grass and Bermuda-buffalograss pastures fit into the grazing program. Forage sorghums, combinations of oats and sweetclover, or Johnsongrass, sweetclover, and Sudangrass make good hay. Corn, grain sorghum, and barley—common crops of the area—give excellent winter or dry-weather feeding or for finishing.

Although substituting soil-holding crops for row crops is the main advantage of adding cattle to the Blacklands farm plan, Temple scientists noted other advantages. It was found that many of the grazing and feed crops can be drilled without any previous land preparation. This cuts production costs and lessens soil compaction caused by the excessive use of heavy machinery.

FOUR-DAY RAIN in May 1953 washed soil at 7.9 tons-per-acre rate and 3.3 inches of water into basin. Cornfield was seeded to cotton.

OATS AND SWEETCLOVER in adjacent field withstood same 4-day r let only one-tenth inch of water and trace of soil wash into ba

hat's good for the Blacklands?



2 Nitrogen-building sweetclover to boost corn yield

RESEARCH AT USDA's Blacklands Experiment Station, emple, Tex., showed nitrogen is the key to higher corn ields—that these low-yielding deep clay soils of this area ›uld be producing 50 bushels of corn per acre.

Station superintendent R. M. Smith and his associates ›und that the soils have ample potash and trace elements, ut not enough phosphorus. Most crops respond well to :arly soil treatments with 30 to 60 pounds of P_2O_5. That ill leaves nitrogen to be accounted for.

Are nitrogen fertilizers necessary when corn is grown ›ntinuously on the same land? Can nitrogen-fixing veetclover grown in rotation with corn provide enough f this important plant food? Four years of plot and field ials apparently answer "yes" to both questions.

On continuously cropped corn land, the application of 0 to 90 pounds of nitrogen per acre increased yields by 0 percent—from 38.8 to 42.9 bushels.

Although only a few Blacklands farmers rotate corn ith sweetclover, such a rotation in experimental plots at he Temple Station showed these significant results:

1. Corn grown after sweetclover averaged 50 bushels er acre. Addition of nitrogen fertilizer failed to give igger yields. Similarly, corn grown on sweetclover land nder supplemental irrigation yielded at least as well *with-ut* as *with* nitrogen fertilezer—89 bushels per acre with-ut nitrogen and 86 bushels with nitrogen.

2. This legume crop plowed out in early summer left he land in good condition for corn and *containing a igher than normal supply of moisture.* Others working vith this problem in western dryland areas of the U. S. ave found that normally sweetclover uses more moisture han corn. But here at Temple, the fact that the legume s plowed down early, plus its ability to keep the fine-extured soil in a prime condition for water absorption, ffsets sweetclover's big appetite for water.

Scientists at the Temple station conclude that nitrogen fertilization is most important when corn is continuously cropped; but that for corn-livestock farmers, even better yields can be obtained from a corn-and-sweetclover rotation. The researchers judge that sweetclover returns about 100 pounds of nitrogen per acre.

Supplementing rainfall with irrigation water gives yields a further boost—and may result in better use by the corn of any nitrogen fertilizers in the soil. Irrigation allows a grower to double his planting rate profitably (from 6,000 to 12.000 plants per acre). Under these conditions, one series of trials with corn after sweetclover yielded an average of 92 bushels per acre.

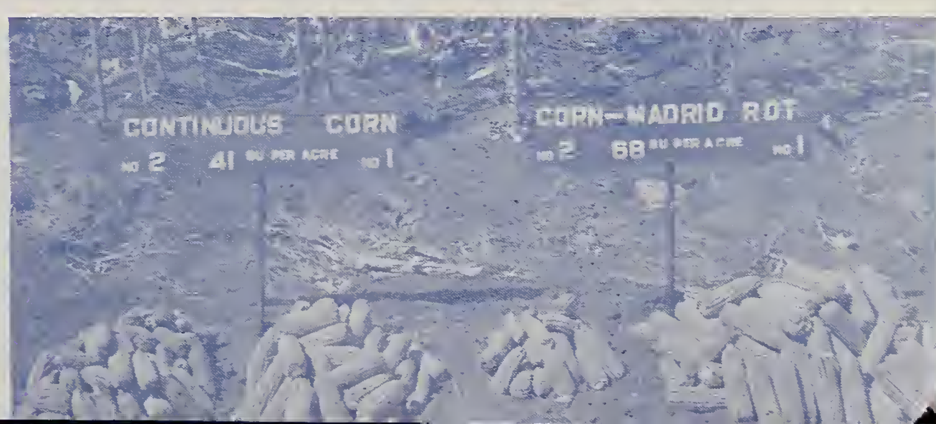
The Temple researchers gained other significant information about corn's need for and use of nitrogen by analyzing corn leaves for their nitrogen content.

Setting 3 percent nitrogen as the approximate critical level for plant response, the researchers found ample nitrogen in the leaves of all young corn—even that grown on continuous corn land. Nitrogen shortages began to occur as corn reached full tassel. Then, when this plant food was most needed, its level dropped to 2 percent in leaves of corn on continuously cropped soil, slightly below 3 percent in corn on sweetclover land.

Nitrogen fertilizer at the 90-pounds-per-acre rate on continuously cropped land increased leaf nitrogen to 2.89 percent. But it took nitrogen plus supplemental irrigation water to reach 3 percent.

Nitrogen fertilization of corn on sweetclover land boosted content at full-tassel stage to 3.12 percent.☆

SWEETCLOVER rotated with corn raised corn yield in an experimental plot (right), but growing corn year after year (left) kept yield down.



food and home

NEW USES FOR FATS AND OILS

Unusual properties give these chemically modified products great potential

STARTING MATERIAL for surprising new acetostearin products is hard, high-melting tristearin (left). Addition of acetic acid to tristearin produces the malleable acetostearin material that's folded over spatula (right).

OUR FAMILIAR fats and oils—lard, cottonseed oil, soybean oil, peanut oil, and others—may soon find surprising new uses. Changed chemically into new substances, these products may be used to keep foods fresh longer, make spreads spreadable over a wide range of temperature, produce top-quality plastics, and even to enhance milady's complexion.

These unusual modified fats and oils are known as acetoglycerides. They have been produced at USDA's Southern Regional Research Laboratory, New Orleans, La., by acetic-acid treatment of ordinary fats and oils. Chief among their unique properties is an exceptionally wide range of plasticity and the ability to exist as non-greasy, plastic solids. These qualities make acetoglycerides of great potential value to industry. Furthermore, they can be tailor-made to give them properties desired for particular uses.

Acetoglycerides were recently approved for use in cosmetics. Both ARS and industrial laboratories are now making careful studies to determine whether acetoglycerides are suitable for use in foods. Such suitability must be fully established before the new products can be considered for potential food uses.

There are two general types of acetoglycerides—acetostearins (relatively solid in form) and *aceto-oleins* (more like liquids). Some of the acetostearins have a high melting point (well above 100° F.), others melt at lower temperatures.

The *high*-melting acetostearins may find use as edible protective coatings on foods. Applied to fresh and processed meats and poultry by dipping, these thin, almost-invisible films retard loss of moisture, flavor, and aroma, and can serve as carriers for antioxidants to prevent rancidity. Commercial tests will determine whether such coatings are practical. The films have also been considered as protective coatings on cheese, nuts, fruit, and baked goods. Including acetostearins in chocolate-coatings for ice-cream bars and candies reduces brittleness at low temperature.

Preliminary tests suggest that the *low*-melting acetostearins may find use as slab dressing in making candy, as a roasting oil for nuts, as anti-clumping oil for raisins. These are but a few of the potential applications. The fact that acetostearins have extraordinary resistance to oxidation, rancidity, and chemical change (compared with ordinary fats and oils) should add considerably to their value for the food industry.

Aceto-oleins have been used so far mainly in research on a special spread for military rations. This spread resists melting in the Tropics and freezing in the Arctic, retains good flavor even when stored under adverse conditions. Taste panels found it much like margarine in flavor, texture, and appearance. The Quartermaster Food and Container Institute for the Armed Forces is preparing specifications for trial commercial procurement of "global spread"—so named because this product can be used satisfactorily anywhere in the world.

Various acetoglycerides are potentially important for use in cosmetics—including creams, lotions, and lipsticks—and as plasticizers. Plastics made with them have good resistance to weathering, remain clear and flexible at low temperatures. Acetoglycerides can be made colorless, odorless, and flavorless. Natural animal fats or vegetable oils used as starting materials make up 80 to 90 percent of the final product.

Existing processes for modifying and purifying fats can readily be adapted for producing acetoglycerides. Essentially, they're made by substituting acetic acid for some of the fatty acids ordinarily combined in the fat or oil molecule. Their properties differ with the amount of fat replaced by acetic acid.

Acetoglycerides should open many new markets for our increasing supplies of edible fats and oils. At least 8 companies have prepared acetoglycerides in the laboratory or pilot plant, and 2 of these companies now offer experimental samples to possible commercial users.☆

How Insects Help Poultry Breeders

FRUIT FLIES CAN GIVE ANSWERS IN WEEKS INSTEAD OF YEARS

RESEARCHERS are using fruit flies in pilot studies to predict the effectiveness of various types of poultry breeding. This time-saving work is under way at Lafayette, Ind., where the testing station of the North Central States Regional Poultry Breeding Project is located.

It takes poultry researchers, breeding for egg production, a couple of years to get a full egg-production record. Using fruit flies instead of chickens, the scientists get similar breeding data in a few weeks.

That's because chickens and fruit flies vary in a significantly similar manner in respect to rate of egg production and egg size relative to body size. Although the fruit fly (*Drosophila melanogaster*) has only 8 chromosomes and the hen has 72, both animals have the same type of gene action. In each there is about 10 percent heritability of the egg-production character and something like 30 to 40 percent heritability of the factors governing egg size.

This cooperative poultry-breeding project is conducted by 12 North Central States and USDA (AGR. RES., June 1955, p. 10). Funds for the insect research have been supplied by the Rockefeller Foundation and the National Science Foundation.

Purdue University and ARS have cooperated closely in the fruit-fly phase of the work since 1949. Pilot studies, in which one group of flies was carried to the 144th generation of full-brother-and-sister matings, have shown that some families of flies can be inbred successfully and some cannot. Some die out. Much the same thing has been learned in working with poultry.

Technicians collect the daily egg production from individual fruit flies in a banana-agar medium. They measure egg size by length and record egg hatchability and the body weight of the flies. This data is studied to determine the effectiveness of various types of poultry breeding, including conventional family and individual selection, inbreeding, hybridization, and recurrent selection.

Researchers say there are indications from this work that elite combinations are less likely to come from mating two superior-performing inbreds than from mating a superior line with an average or inferior performer. So, they say, it may not be good policy to screen inbred lines too closely for vigor before testing them in combinations.

This phase of the project was expanded in 1954 to include work with the Tribolium (flour) beetle. The body weight of the flour beetle is obtained in the pupal stage, and egg production and hatchability are recorded as with the fruit fly.

Although flour beetles yield data only about half as fast as fruit flies, researchers believe the beetle may have some advantages. Environmental conditions can be controlled somewhat better because the culture medium is primarily whole-wheat flour. In addition, the beetle has 20 chromosomes, compared with the fruit fly's 8, so some scientists believe the beetle may serve as a more critical test organism for poultry breeding methods. ARS and Purdue are cooperating in this work too.

Since rate of egg production isn't a highly heritable characteristic, one aim is to find lines of poultry that complement each other. The researchers look for crosses with a "favorable" combination of genes (heterosis) for rate and persistency of egg production. To a degree, this search can be pursued rapidly and with workable accuracy using fruit flies and flour beetles. But in the long run it has to be checked out with chickens under normal environment, diet, and disease variation.

The Lafayette laboratory is also concerned with the livability of chicks and the measurement of egg quality in breeding material sent in by the 12 participating State experiment stations. Tests of these qualities can't be run in time-saving correlation with fruit flies, as can the tests for rate and persistency of egg production.

All this means the ideal layer won't be tailored overnight—but promising progress is being made.☆

FRUIT FLIES kept in banana-agar medium in cream bottles at Lafayette are observed by C. H. Moore, ARS, A. E. Bell, Purdue.

HYBRID HEN under test in North Central Regional Poultry Breeding Project is examined by Moore and Director D. C. Warren.

Light and Fungi

KNOWLEDGE OF HOW THESE PLANTS REACT TO LIGHT MAY HELP US WORK WITH THEM AS WELL AS INVESTIGATE HIGHER PLANTS

FUNGI, a low form of plants, can't use light for photosynthesis as *green* plants do in making carbohydrates. But the fungi *do* resemble these higher plants in some other responses to light.

A study of fungi in relation to light at USDA's Plant Industry Station, Beltsville, Md., is giving a better understanding of the physiology of fungi. That's important because fungi are important to man. They are the source of both serious diseases and valuable antibiotics.

ARS mycologist W. D. McClellan has been making these light studies in association with physiologist H. A. Borthwick and chemist S. B. Hendricks, who for several years have been investigating the effects of light on flowering, seed germination, and other phenomena of higher plants. (See AGR. RES., May–June 1953, p. 3, and June 1954, p. 8.)

The basic light reaction that regulates certain phases of growth in higher plants may also be responsible for some light responses of fungi. If so, fungi might become very useful in further investigation of the general principles of how living organisms in general react to light.

McClellan has reported recently on tests of 13 different fungi, 8 of which gave definite light responses. Some produced spores as a result of stimulation by certain types and intensities of light in specific color bands, and some did not. Light response of some fungi was indicated by variations in the amount and kind of color they developed. With others, light affected the formation of pycnidia (small spore-bearing bodies), and in another case light stimulated the formation of sclerotia (groups of thick-walled cells).

Various kinds of fungi were grown in test tubes at controlled temperatures, either in the dark or with light from incandescent-filament or fluorescent lamps. The fungi were later subjected to lights including unfiltered light from each of these sources, far-red light (wave-length greater than about 7,000 angstroms) isolated by appropriate filters from the incandescent source, and blue and red lights that were similarly isolated from the fluorescent source.

It appears from results so far, that some cultures produce spores only when exposed to incandescent, fluores-

SEVEN DISEASE FUNGI in the 7 columns vary in production of spores under different lightings. Most spores show black, but other bodies have darkened middle and lower cultures in columns 4 and 6. Brown rot fungus in column 1 sporulates best in continuous dark and none in continuous light. Leaf-spot fungus of tung trees and leaf spot of gladioli (columns 2 and 7) react in the opposite way.

cent, or blue light and do not sporulate under red or far-red light, or in the dark. On the other hand, one of the fungi tested, *Monilinia fructicola* (the organism that causes brown rot of peaches), sporulates abundantly in the dark and when exposed to far-red and red lights, but it fails to do so when exposed to blue, incandescent, or fluorescent light.

Both the quality and energy value of light seem to influence the light responses of fungi. Also the stage of development at which fungi are exposed to light determines their responsiveness in some cases. The researchers found that one of their test fungi became responsive to light on the third day of growth, when only 7 hours of fluorescent light was enough to stimulate production of spores. Once triggered by this light exposure and then returned to the dark, the fungus continued spore production. But if the culture was given the same allotment of light before the third day of growth, it did not produce spores.

Scientists may now be able to use light or darkness—depending on a particular fungus response—to make disease fungi form spores when they're needed for test inoculations in plant-disease research. Scientists also will find light a useful tool in classifying hard-to-identify fungi. Some fungi can be forced by light into the perfect-reproduction stages that reveal true identity of the species.

The fact that fungi don't need light for photosynthesis eliminates one light influence that complicates study of higher plants. Moreover, fungi live on ready-made food sources—don't manufacture their own nutrients—so scientists can limit the kinds of food available to them and study the interaction of nutrition and light. It is possible, therefore, that fungi could be particularly useful tools in studying nonphotosynthetic light requirements of plants in general.☆

SAVING RUSSETS FROM WILT

■ VERTICILLIUM WILT DISEASE of popular russet-type potatoes is yielding to research by USDA and Idaho experiment station scientists.

Since 1949, they have directed most of their efforts toward development of varieties resistant to verticillium fungus, which cuts 20 percent from the russet crop in the large producing area of eastern Idaho. Losses in some localities have run as high as 50 percent.

The disease shows up in the plants late in the growing season—when it's too late to do much about it. The insidious mode of attack has been an important cause of heavy losses from the disease.

At Aberdeen, Idaho, breeders tested some 1,200 potato varieties and numbered seedlings for resistance to the wilt. The most promising lots were given a year or more of testing at another location in the region where the disease is the chief factor limiting potato production.

These tests showed a striking difference in the way verticillium wilt progresses in young plants and in those close to maturity. Symptoms that were delayed in young or actively growing plants tended to show up under all conditions that hastened maturity—early planting, early irrigation, high temperature, or use of an early-maturing variety.

The tests also indicated that the wilt could be delayed or even prevented in susceptible varieties by using seed tubers only 6 months of age instead of the usual 12-month-old tubers. The researchers believe that susceptible varieties might possibly be grown as a commercial crop in badly wilt-infected areas by using young seed tubers that have been produced far to the South during the winter.

In their efforts to find plants to cross with wilt-susceptible russet varieties, the breeders have discovered, among 100 named varieties and 1,100 seedlings, many variations of resistance and susceptibility. Nine late varieties and three late numbered seedlings have been found highly resistant. A medium-maturity seedling, No. 41956, also showed high resistance and is considered promising material for crossing with russets. This seedling, however, is pollen-sterile as is also the high-quality, midseason, wilt-susceptible variety Russet Burbank. Therefore, no cross is possible directly between these two.

In order to incorporate the wilt resistance of No. 41956 into a russet-type plant, pollen-fertile russets (of which there are several) must be used as the second parent plant. The perfect-flowered seedlings then obtained can be crossed with Russet Burbank as one of the parents. Early Gem is the result of such a two-way crossing.☆

Black Pepper Comes West

IMPROVED PROPAGATION METHOD IS AIDING ESTABLISHMENT OF PLOTS IN PUERTO RICO

DEMAND for black pepper among United States cooks and chefs pushed the imports of this most popular of our spices to about 35½ million pounds last year. Prices—the average was 73 cents a pound wholesale in 1954—are subject to extreme fluctuation depending on supply.

Unsettled political conditions in the Far East cause our source of pepper supply to be continually threatened. That's why USDA plant-introduction scientists are considering prospects for commercial blackpepper culture in the American tropics, particularly in Puerto Rico.

For this purpose, cuttings and seeds from many sources, including a collection by ARS botanist H. S. Gentry, have been grown under quarantine at USDA's Plant Introduction Garden, Glenn Dale, Md. Here, by applying newer propagation methods than those used for centuries in the Far East, horticulturists have speeded up the growing of enough pepper plants for field trials in Puerto Rico.

In pepper-growing countries, vegetative cuttings up to 2 feet in length are used for propagation since the seed does not run true to variety. The cuttings are pushed into the ground around the base of a shade tree or in a nursery bed. Rooting takes several months and survival is sometimes as low as 5 percent.

At Glenn Dale, out of a shipment of 200 cuttings of 2 high-yielding varieties from India, only 14 percent rooted after 2 months and longer, even under ideal greenhouse conditions. Survivors were used for trying more rapid propagation methods.

Pepper vines develop aerial roots at the leaf nodes. These aerial roots function as normal roots in the soil. Using single pepper-vine leaf-node cuttings, horticulturist J. L. Creech reports rooting the first leaf-node plants in 7 to 14 days.

An aid to faster propagation devised at Glenn Dale now supplies leaf cuttings with roots already developed, eliminating the care needed by unrooted cuttings. Bamboo poles covered with sphagnum moss are placed behind each plant. As the pepper vine grows, each leaf node sends roots into the moist moss. The roots also help to hold the vine upright. When the vine reaches the top of the pole, a new crop of cuttings is ready.

A quantity of black-pepper leaf-node cuttings was shipped to the Federal Experiment Station in Puerto Rico between September 1953 and July 1954. H. E. Warmke, officer in charge, reports that these plants have been increased to 2,400. They're thriving and seem well adapted to the tropical conditions. Warmke says it's too early yet to evaluate black pepper as a commercial crop for the island since it takes 3 to 5 years to reach a marketable stage.☆

NEW CUTTINGS from this pepper vine will provide 8 to 10 new plants. Pole, covered with sphagnum moss, is placed back of plant. As vine grows, leaf nodes send aerial roots into moss. This method was devised by ARS scientists as an aid to faster propagation.

PLANT STOCK is cut back from top of pepper vine and a single leaf-node cutting (left)—potted in greenhouse—will soon provide a new crop of cuttings. Leaf node develops long leaders from auxiliary buds in 6 weeks (right). New plant is up on mossy pole in 2 months.

FIELD PLANTING of young pepper grows on farm of commercial cooperator near Mayaguez, Puerto Rico. This project is supervised by the Federal Experiment Station of Puerto Rico, occupies from 2 to 3 acres. Cuttings were furnished by the Glenn Dale garden.

dairy

HERD BEHAVIOR and MILK PRODUCTION

■ SOMETIMES DAIRYMEN FACE temporary milk production declines without knowing the cause. Research conducted by ARS shows that sudden changes in herd makeup are frequently responsible.

Animal-behavior studies by M. W. Schein, Federal-State collaborator at USDA's Dairy Field Station, Jeanerette, La., indicate that milk and butterfat production can drop off as much as 5 percent when a totally strange cow is suddenly added to a well-established herd. Such changes create excitement, marked by butting, kicking, and threatening, until the intruder is accepted and a new social order is established. Until this happens—and it may take many days—milk production suffers. It picks up gradually as fighting tapers off and peace is restored.

But the newcomer may upset the social structure of the whole herd. Armistice may find the erstwhile stranger dominating all others—or at the lowest social level. The period of herd readjustment depends largely upon the individual aggressiveness of the cows involved.

What happens when a cow is returned to a herd of which she was once a member? The studies show that a cow absent only a few days causes little unrest on rejoining the herd. She immediately takes her previous social position and herd business is not noticeably interrupted.

But herd readjustment may take 1 to 3 days if a cow has been absent 6 to 10 months. Readjustment is marked by threats rather than by fighting. The time required depends to some extent on the cow's previous social position. Tests showed that little change in milk production can be charged to reintroduction of semi-strange cows into a herd.

Schein points out that behavior findings are important only if they affect milk production. "Dairymen, themselves," he says, "must judge whether a temporary upset is important. This takes close observation of the herd and selection of the most favorable time to make changes."

A dairyman may not, for example, want to place totally strange cows in his herd when milk prices are seasonally high and every pound of milk and butterfat counts. On the other hand, the dairyman who produces his own replacement stock may rarely have a serious problem.

Studies are being continued at Jeanerette to examine the effects of handling and care of dairy cows on behavior and milk production.☆

Readers' REACTIONS

Coming

Government regulations require us to circularize the AGRICULTURAL RESEARCH mailing list to make sure that copies are sent only to those who want to receive them and that addresses are correct.

Some of you will receive a card in the next few weeks.

Please look out for this card and return it promptly if you wish to retain your name on our mailing list. Just check your address, making any necessary changes *including zone number*, put a 2-cent stamp on the card, and return it.

If we don't hear from you within 30 days, we must assume that you wish us to remove your name from the list.—ED.

Sent

SIR: I am interested in this ear tag, shown best in picture 11 ("Learning How To Breed Better Beef," AGR. RES., April 1955, p. 3). We are searching for a good method of eartagging our 4–H Club baby beeves when we weigh them in at the start of the feeding period.

Would you please furnish me with the name and address of the company that makes this ear tag? We would like to find a tag that will stay in the ear and still not harm or deform the ear.—JAMES C. HODGES, County Extension Director, Burlington, Iowa.

● B. M. PRIODE, Superintendent, Beef Cattle Research Station, Front Royal, Va., furnished the information.—ED.

Here

SIR: Each week I do a television program, a radio program, and prepare a news article for the Sunday edition of our leading newspaper.

I find more usable material from AGRICULTURAL RESEARCH than any other source.—ALFRED CROCKER, County Agricultural Agent, Dickinson, Texas.

● Thanks. We're always interested in how this publication is used. (PS: note pages 8 and 9 this time.)—ED.

agrisearch notes

NOTABLE ACHIEVEMENTS in Federal-State cooperative research have won the coveted Hoblitzelle agricultural awards for 2 researchers in USDA and 1 in the Texas experiment station.

ARS soil scientist S. R. Olsen, working with the Colorado station at Fort Collins, won $5,000 and the gold medal in agricultural science with his "baking-soda test" that shows how much phosphorus a soil has available to plants (Agr. Res., Oct. 1953, p. 6).

J. C. Stephens, ARS plant breeder, and J. R. Quinby, superintendent of Texas station's Chillicothe branch, shared $5,000 and won gold medals for advancement of Texas rural life for making hybrid grain sorghum practical through use of a male-sterile breeding line (Agr. Res., June 1954, p. 14).

FIFTEEN GRAIN WAREHOUSES in the Southwest, some quite large, have been wrapped in tarpaulins and fumigated—buildings, contents, and all—with methyl bromide to get rid of the feared khapra beetle, worst pest of stored grain in some countries.

Although the insect has been known in this country less than 2 years, its destructiveness and its known potential have spurred many groups to launch a unified extermination program. USDA entomologists, State and county pest-control agencies and property owners are working together and sharing the cost. Chemical companies helped with the tests.

The khapra beetle inhabits warehouses, mills, feed stores, farm storage, and other places where grain or seed are found. It has been known to work its way through a 2-foot brick wall, also to penetrate 21 feet deep in a mass of grain. It is persistent—hard to kill.

Properties where the beetle showed up have been put under Federal and State quarantine. That prohibits the shipping of grain, grain products, bags, or other exposed materials from the property until thoroughly treated or found free of the beetle upon inspection.

The khapra beetle was first discovered in California in November 1953. It is now found also in Arizona and New Mexico. Pest control officials expect to clear up the New Mexico infestation within a few weeks. Additional States are being surveyed to see whether the beetle has spread beyond the presently-known areas of infestation.

The khapra beetle is believed capable of building up not only in our warmer States but also in heated warehouses all over the Nation.

AMPLE, WELL-PLACED FERTILIZER, and lime where needed, would save lots of forage seed and the potential pasturage otherwise destined to fail.

At USDA's Research Center, Beltsville, Md., plots seeded several ways to put high-phosphate complete fertilizer near the seeds averaged 2,210 pounds weed-free forage per acre, first crop. But plots with either fertilizer or seed broadcast had 40 to 70 percent weeds and averaged only 410 pounds of desirable forage.

ARS agronomist D. F. Beard says stand failures cost farmers $50 million a year in wasted seed alone. Inadequacy of nutrients and poor placement of applied nutrients in the soil relative to seed location are big causes of loss.

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